

VIII. *Descriptions of two new Strepsipterous Insects from Albania, parasitical on Bees of the Genus Hylæus; with some Account of their Habits and Metamorphoses.* By S. S. SAUNDERS, Esq.

[Read 1st April, 1850.]

MUCH insight has gradually been obtained, especially during late years, into the singular economy of the *Strepsiptera*, which has formed the subject of several interesting notices in the Transactions of this Society, followed by many important facts recorded by Dr. Siebold of Erlangen,* by an elaborate paper, accompanied by microscopic details of extreme nicety, contributed by Mr. George Newport to the Transactions of the Linnæan Society (vol. xx. part 2, 1847), by critical disquisitions on their affinities by Mr. Newman, published in the *Zoologist*, &c.; and in adding to the list of this pigmy tribe, two new species, reared from the bodies of bees, of the genus *Hylæus* of Latreille (*Prosopis* of Jurine), I avail myself of the opportunity which presents itself, to offer some remarks on their eventful history and extraordinary career.

The first of these species I obtained from a large oak-gall, which, being tenanted by some Hymenopterous larvæ, I had placed in a box, where it remained forgotten until autumn, when, I observed, among several specimens of *Hylæus*, which had been produced and died in the interim, some exhibiting abdominal protuberances, caused by the presence of Strepsipterous insects, still shrouded in their pupa envelopes, having perished *in situ*, although ready to burst forth in the imago state.

The following year my endeavours to obtain more of the *Hylæi* from oak-galls proved ineffectual; but knowing that these bees also nidificated in briars, I collected a quantity of briar-snags, and on the 28th of May, having examined some of the cells, I selected from among their occupants five already-formed pupæ, the remainder being still in the larva state; of these pupæ three completed their transformations after the lapse of two days, when I had the satisfaction of perceiving that each of the bees then produced presented the usual parasitical phenomena, not previously apparent; and the next morning, on placing them in a phial accessible to the sun, two of the winged parasites—smaller than those previously obtained from the *Hylæus* of the gall—speedily

* In Weigmann's Archiv für Naturgeschichte, 1843.

came forth. The remaining pupæ, selected as aforesaid, having perhaps experienced some injury, never attained the imago state.

From the ample stock of larvæ and briars remaining, I expected to have been able to obtain a considerable number of the parasites; but in this I was mistaken, the gestation of the latter apparently rendering the *Hylæus* precocious,* for none of the bees whose metamorphoses were deferred to a late period produced any parasites; such transformations being, in some cases, exceedingly protracted and irregular. I noticed the same result on other occasions, those bees which produced parasites being always observed in the imago state before others not parasitically affected; their appearance varying, according to the season, from about the middle of May to the middle of June.

The parasitic pupæ—with the exception of one possibly overlooked at first—always appeared contemporaneously with the imago-bee (never sooner), whose contortions in wriggling itself out of the pupa-envelope may not impossibly assist the parasite in driving the prominent carinated apex of the male pupæ, or the subcuspidate cephalo-thorax of the female, through the abdominal folds. Jurine, however, on one occasion discovered no less than six larvæ entirely concealed within the abdomen of a fully-developed *Polistes*;† and Mr. Westwood, also, “in examining the interior of the abdomen (of an *Andrena imago*), from between the segments of which the heads of two *Stylops* larvæ were exerted, found a third larva similarly attached, but entirely hidden within the abdomen of the bee.”‡ It may therefore be assumed, as Dr. Siebold appears to think, that the preliminary act of protruding its head is performed by the parasite previously to entering upon the inert pupa state, its anterior region becoming indurated about that period, and subsequently (as Professor Peck, of Boston, also observed) presenting a “rounder form;” although, indeed, it may be difficult to determine with precision when the one condition terminates and the other commences; the outer tegument not being discarded at the time, but the real pupa or nymph remaining encased, and finally divesting itself of its slender pellicle within; where, as I shall have occasion to explain, it may continue for some time undisclosed in the imago form. The rapidity however with which, in these parasites on *Hylæus*, this

* A similar circumstance was noticed by Mr. Thwaites, in a species of *Andrena*; as mentioned in Westwood's *Introd. Mod. Classif. of Insects*, vol. ii. p. 300, note. [Just as the presence of the *Blastophaga* by caprification renders the figs precociously ripe.—*Trans. Ent. Soc.* vol. ii. p. 214.]

† *Mem. Acad. Turin*, tom. xxiii.

‡ *Trans. Ent. Soc.* vol. ii. p. 185, note.

ultimate transition has been accomplished in some instances,—the winged parasite having been produced as aforesaid within twenty-four hours after the first indication of its presence between the abdominal folds of the newly-developed bee,—would seem to imply that the entire change, from larva to imago, can scarcely be effected, as it were, *per saltum*, on such occasions.

Among a number of other larvæ and pupæ of *Hylæus*, set apart and carefully watched, I could discover no symptom of Strepsipterous distension during either of those stages; but at length having noticed two pupæ, extracted from a briar, on the 2nd of June, exhibiting on the right side only the dark markings which usually precede the development of the bee, I found, on their pupa-pellicles being discarded the next day, that Strepsipterous parasites, ready to burst forth, had become conspicuously prominent on the opposite side, where their hitherto concealed presence would seem to have had the effect of exhausting the ordinary secretions within. I am also inclined to believe, upon a comparison of numerous specimens of *Hylæus*, reared from the briars, that the colour of the abdomen in the perfect bee was often considerably affected by the abstraction of those substances which had afforded sustenance to Strepsipterous intruders (particularly where the winged parasites were produced), as in the pale-coloured specimens now exhibited.

So long as the *Hylæi* remained in the dark, the parasites, deprived of those external influences which, under ordinary circumstances, would serve to stimulate their dormant energies, made no attempt to abandon their pupa tenements; as an incentive to which, light appears to be absolutely essential, in order that their perceptions may be awakened to an intuitive consciousness of the bees having quitted their cells. Thus, as with those first obtained from the oak-gall, some briars occupied by the larvæ of the *Hylæi* having remained shut up in a box, and the bees having come to maturity and died unobserved, none of the parasitic skull-caps were found to have been removed,—an operation which seems attributable, therefore, to the unaided efforts of the parasite from within; so that, although fully prepared to quit their pupa-cases, unless the parasites be aroused from their lethargic stupor by the exhilarating influence of the solar rays, they terminate their existence, together with the bee, without ever regaining that liberty of action which at an earlier period they were privileged to enjoy in their incipient hexapod larva form; for, as Dr. Siebold's careful investigations into the economy of the *Strepsiptera* have served to elicit, the little acariform beings so frequently

seen to emanate from what had formerly been regarded as mere abortive Strepsipterous larvæ, under the influence of some other parasitical attack, now require to be acknowledged as the true lineal representatives of insects of this order, the perfect female retaining the vermiform condition, and remaining encased in the the body of the bee, into which, at an earlier period, the young hexapod may have found means to insinuate itself, her cephalo-thorax being the only part externally visible.

In an early part of the Transactions of this Society,* Mr. Westwood, in describing and figuring some of these hitherto supposed hexapod parasites upon the *Strepsiptera*, appended a note to his remarks, suggesting "that the individuals producing these minute parasites might be females, and the parasites their young," which Dr. Siebold's observations have served to confirm; and Mr. Newport has since illustrated, with inimitable precision, the whole series of changes which "take place in the ovum within the body of the female *Stylops* herself, contained within that of the bee.†" It may indeed be observed, that the primary question as to the *origin* of these ova, is not hereby entirely set at rest; nor is the distension progressively acquired by such ova of unexampled occurrence, as it is recorded also among the *Tenthredinidæ* and *Cynipidæ*; neither does it appear that their presence has ever been detected in any vermiform Strepsipterous insect obtained from a bee not taken at large, whereby the possibility of extraneous ovi-position (considering also the previous seclusion of the internal-feeding larva within the body of the bee) would be absolutely negatived; but the circumstantial evidence affecting the relations of these hexapods with the *Strepsiptera* is so convincing, and the conditions essential to their future maintenance and propagation—involved in the exploded theory of their hyper-parasitic character—have been so nearly reduced to an *argumentum ad absurdum* by Mr. Westwood,‡ that no reasonable doubt can be entertained upon this point.

These never-to-be-emancipated females, in their apodal apterous imago-form, destitute also of visual organization and antennæ, wherewith their more favoured partners are so munificently endowed, may be recognized by the depressed condition of the exerted cephalo-thorax, which is but slightly concavo-convex, and usually of a paler colour than the distended conical

* Vol. 2, p. 187.

† Trans. Linn. Soc. vol. xx, p. 339.

‡ Westwood's Introd. &c. vol. 2, p. 303.

cephalo-thoracic caps of the pupa cases from which winged males may be obtained. The latter exhibit also a transversely carinated apex, furnished with three small equidistant basal rugosities above, two others, somewhat larger and wider apart, being seen upon a parallel line lower down, when viewed in front; the occipital summit being traversed by a faint sutural line, where this capsule or operculum eventually separates, being thrown off as a mask on the exit of the perfect insect. The apod female, moreover, is not devoid of certain additional discriminative characters, wherein, however, the condition of the cephalo-thorax appears to be subject to considerable modification; which (whether depending upon generic, specific, or metamorphic distinctions) a comparison between the figures and descriptions of this part in the *Xenos Rossii*, as given by Dr. Siebold,—in the *Stylops aterrima*, by Mr. Newport,—and in these parasites on *Hylæus*,—may serve to exemplify.

In this latter sex also a small glossy distension towards the anterior portion of the cephalo-thoracic region, is observable on each side, and dark protuberances at the basal angles, corresponding apparently with others more prominently developed in the pupa-cases of males, and analogous to those noticed in other instances by different observers.*

With respect to these several markings and protuberances, the question naturally suggests itself, to what corresponding organs they may respectively be referred, regard being had also to the very limited portion of the cephalo-thoracic region strictly attributable to the head itself, according to the relative distribution which has been ascribed to the larva-segments. This brings me to notice a remarkable circumstance to which Dr. Siebold has directed attention,† namely, “that the feet of the pupa lie,” as he states, “always and *ab initio* beneath that surface of the pupa-case which is turned away from the ventral region of the stylotized Hymenopterous insect; . . . whence it is to be understood that the *convex* surface of the cephalo-thorax” (as represented in his figures) is the *ventral*, and the *concave*, the *dorsal* region;” and, furthermore, that he had “likewise always distinctly observed, when the males of *Xenos Rossii* were on the point of issuing, after the operculum of the pupa-case had been cast off, that they had both their face and their feet turned away from the

* See the figures of supposed larvæ with exerted heads, as represented by Mr. Curtis (Brit. Ent. pl. 226, fig. B.); by Mr. Westwood (Trans. Ent. Soc. vol. i. pl. 17, fig. 9, 10, 12); by M. Léon Dufour (Ann. Sci. Nat. tom. 7, 1837, pl. 1. fig. 15, &c.).

† Loc. cit. p. 152.

body of the Hymenopterous insect; and, consequently, that those *Xenos* males which had become transformed into pupæ on the dorsal region of the *Polistes gallica*, emerged from their pupa-cases with the ventral side uppermost."

Notwithstanding the frequent opportunities of noticing so anomalous a proceeding, which have from time to time presented themselves, no mention of such a circumstance appears among the observations hitherto recorded in connection with the ultimate ecdysis of Strepsipterous parasites; nor can I supply any corroborative testimony on the present occasion; for whenever I have seen any of these parasites produced, or have extracted them from their pupa-cases, I should say (speaking from recollection) that their position was the reverse of that described by Dr. Siebold, and as such, not calling for remark. Dr. Siebold's expositions upon this point are however so precise, and his opinions entitled to so much weight, that all controversial discussion upon the subject must resolve itself into a careful comparison of facts; the more especially as it was long since remarked by Dr. Peck, that, in the American species which bears his name, "the head of the larva was, in the feeding state, turned towards the base of the abdomen of the wasp;" this direction being subsequently reversed prior to its exit (those found by Jurine, as before stated, being in this position); so that, supposing the larva to double back upon itself for such purpose, in close contiguity along the upper abdominal region, as appearances would seem to indicate, the natural result of this proceeding would be, to subvert its original position within the body; which the male might afterwards rectify within the pupa-case.* Analogy moreover would seem to lead to the conclusion, that the oviduct being situated on the convex upper surface of the cephalo-thorax in the females, this position is more appropriately ascribed to the ventral than to the dorsal region.

With all its superior organization—exhibiting so marked a contrast with the hapless condition of its secluded partner—the delicate conformation of the male throughout this tribe, at once suggests that ephemeral existence which the concurrent testimony of all observers has served to confirm; whereas the functions devolving upon the viviparous female until her hexapod progeny have acquired their preliminary development, necessarily imply a more prolonged, and, in some cases protracted, career; suscep-

* Some pupæ perform a series of evolutions within. (Vid. Ichn.-gyrator, Ann. Soc. Ent. de France, Tome 9, p. 43.)

tible, doubtless, of some subtle appreciations of external influences, although deprived of independent action and visual discrimination. The earliest specimens producing these hexapods, taken at large with the *Hylæi*, were found towards the beginning of the fourth week in June; which, assuming the final metamorphosis of the bees to have been at least synchronous with the most precocious of those produced in the house, would indicate about three weeks as the usual term of gestation in these parasites on *Hylæus*; nearly agreeing with Mr. Newport's computation in the case of his *Stylops aterrima*, namely, about eighteen days.

It has, however, been announced by Dr. Siebold, as if generally applicable throughout this class of parasites, that the hatching of the eggs in the Strepsipterous females proceeds very slowly (*geht sehr langsam vor sich*), and that many of the latter hybernate with the insects upon which they subsist (29th result); which observations however can only be understood as applicable to the females of *Xenos*; and indeed, under the peculiar embryogenous and metamorphic conditions affecting the continuation of the species, it is manifest that these parasites could not perpetuate their existence in company with the social *Vespidæ*, unless the epoch of parturition were thus protracted until the following year, so as to enable them to transfer their hexapod progeny to the succeeding colony of wasps. In the case of *Stylops*, however, the converse necessity exists for the rapid development of the ova, the *Andrenæ* enjoying but a limited term of existence at large, and it being therefore essential that, within the brief period of a few weeks, the female parasite should fulfil the part assigned her, and the young hexapods be ready to occupy their appointed stations in the larva cells of the bee, soon about to be closed. A corresponding urgency is imposed upon these parasites on *Hylæus*; although the larva state of the latter continuing throughout the winter and spring, involves the necessity of a suitable conformity of habit in the parasite, under those altered conditions wherein nature, in the plenitude of her resources, delights to exhibit her ever-varying appliances.

The pupæ of the males, as Dr. Siebold proceeds to explain, always first appearing at the beginning of summer, (*immer erst im anfang des sommers*), but never surviving the winter; it follows that the hexapod larvæ to which he alludes, produced before the aforesaid pupæ of the males, must, by a speedy transition, assume the pupa state at the time when these latter are first observed; which well accords with the habits and equally rapid

metamorphoses of the *Polistes*,* while offering a remarkable contrast to the tardy development of the larvæ of other Strepsipterous parasites, which, like *Stylops*, *Halictophagus*, and those affecting the *Hylæi*, are associated with bees long retaining their immature condition, and enjoying comparatively but a brief existence after quitting their cells in the imago state.

But, on the other hand, it is well known that among wasps, neuters alone are produced up to a certain period, upon which the duty subsequently devolves of preparing the cells set apart for females; and the *Xenos* being essentially dependent upon the hybernation of the latter, the female parasite of the preceding year must either await the occasion when the cells of the female wasps are so prepared for the reception of ova, or otherwise, transmitting her posterity to these females through the intermedium of neuters in the first instance, the *Xenos* would thus prove to be double-brooded, a circumstance which could scarcely have escaped the observation of Dr. Siebold; although indeed the time at which the first pupæ of the males are stated to show themselves, (*preceded* by the appearance of the young hexapods as already recited, such hexapods being also necessarily present *after* the formation of the female cells,) would seem to warrant such a conclusion.†

It has also to be considered that bees, whose vital energies have become impaired, and internal economy disorganized, by the sustenance and accommodation afforded to Strepsipterous parasites, are generally believed to be sterile and impotent; as long since suggested by Kirby, and confirmed by subsequent observers, particularly by Mr. Newport, when describing the condition of the ovaries in his stylopized specimen of *Andrena Trimmerana*. It may then be asked, does this law apply with equal force and effect to the parasite-bearing *Polistes*? If such be the fact, the hybernatating wasps so attacked, not being themselves capable of forming new colonies, the hexapod brood of the *Xenos*, like that of *Stylops*, must be transferred by adventitious means to the larva cells of some other constructor; nor does it seem probable that under such circumstances the unproductive hybernatating *Polistes* should survive to an advanced period, the prevailing efficacy and sustaining power of instinct being already withdrawn.

It does not, however, appear to be specifically averred whether the hexapods and pupæ, which Dr. Siebold noticed so early in

* Saint Fargeau, Suites à Buffon—Hyménoptères, (Histoire des Polistides,) tome i. p. 475, *et seq.*

† Jurine informs us that his males of *Xenos* were produced from the *Polistes*, on the 27th and 28th July, and 1st of August.

summer, were in reality those of the true *Xenos* found upon *Polistes* or those of *Stylops*; some being also mentioned which, completing their final metamorphosis within the space of a few weeks, did not assume the imago state until towards the end of summer (31st result); thus coinciding with the period when Rossi was accustomed to meet with the pupæ of *Xenos*, namely, during the months of August and September.*

It is therefore to be regretted that, by collectively embodying under one category results derived from the *Stylops Melittæ*, *Xenos Rossii* and *Xenos? Sphæcidarum*, and by simply setting forth the deductions so obtained, Dr. Siebold has afforded us no opportunity of classifying the evidence for the purpose of comparison, whereby its bearing upon other points might be correctly ascertained, and a consistent series of well-assorted facts more accurately propounded.

Much still remains to be ascertained in connection with the history of these parasites; no satisfactory explanation having yet been afforded of the phases which more immediately precede, accompany, and follow, the ingress of the hexapod progeny into the bodies of the Hymenopterous larvæ; of the instincts displayed to this effect by the former, the preliminary development acquired by the latter, or the conditions (of abstinence or otherwise) imposed upon the parasites during the interim; nor indeed, after so locating themselves, does it appear unequivocally demonstrated by what process they then pass from the hexapod to the apodal form, unless indeed it should be understood that Dr. Siebold actually verified the casting of the larva skin, (alluded to under his 8th result,) followed perhaps by that atrophy of the organs of locomotion and plethoric distension of other parts, noticed by Mr. Newport in the larva of *Meloë*, although he is disposed to believe that the latter "does not enter the body of the bee-larva; that in all probability it wounds it, and preys on its fluids from without; . . . and either that, having destroyed the recently hatched bee-larva, its first tegument is cast, its mandibles are altered, and it then subsists on the food that had been stored up for the bee in the closed cell, and there gradually changes its form; . . . or that, like the larva of *Clerus*, having destroyed the bee in one cell, it penetrates into another and preys on the inhabitant until it has attained its full growth, when it remains in one of these cells and undergoes its metamorphoses;" various circumstances recited, leading him "to incline to the first of these views." †

* *Fauna Etrusca*, Mantissa, App. No. 97, p. 115.

† Trans. Linn. Soc. vol. xx. p. 354.

At all events, considering the facilities which offer to continental entomologists, of procuring the exposed *Polistes* nests, furnished with the eggs and larvæ of their respective founders in every progressive stage of development, as well as of introducing some of the hexapod parasites for the purpose of watching their operations, it may be assumed that additional links will not long be wanting in order to connect the chain of evidence and complete the magic circle within which the destinies of these singular beings have been mysteriously cast.

Thus Nature, chary of superfluous endowments, and constantly indulging in freaks of inexhaustible variety, adapts and concentrates her resources to the ends to be attained, withholding such organs as circumstances may have rendered unavailing, while conferring additional perfection upon others, the same design being effectually promoted in either case: so that whereas, on the one hand, among the insects now under consideration the short-lived male is appropriately invested with most inordinately expansive eyes and antennæ, wholly unnecessary to the apterous female; the vital energies of the latter are engrossed, on the other hand, by those complex and capacious ovaries which pervade the whole system, suitable for the reception of a multitude of infinitesimal germs,* each constituting the nucleus of a future being, admirably fitted to perform its allotted part, however humble, amid the works of creation: thereby maintaining those due proportions which, regulated by the most elaborate processes of a corrective and compensating tendency, serve to perpetuate the unerring perfection of all: nor among the least curious subjects of inquiry are the laws which govern such divergence of structure and production of dissimilar conditions from homogeneous molecules. While considering the perplexing obscurity in which the biography of these little parasites has hitherto been involved, it cannot be matter of astonishment that their affinities to other Orders, and consequently their fitting position in the natural system, should have given rise to interminable controversy.

With regard to the genus to which these enemies of the *Hylæi* may belong, the general structure of the antennæ and tarsi might tend to associate them with *Xenos*; yet, consorting with the *Mel-lifera*, their habits bring them into close relation with *Stylops* and *Halictophagus*; so that they seem to supply a connecting link between *Xenos* and *Stylops*, coinciding with the position which the *Hylæi* themselves have been considered to occupy between the *Vespidæ* and the *Mellifera*,—thus constituting a new genus, for

* Mr. Newport has computed that more than 7000 hexapods were produced by one female. (Loc. cit. p. 341.)

which I would propose the name of *Hylecthrus*, readily distinguished at first sight by the broad laminæ of the antennæ, which are nearly of equal width throughout, whereas in *Xenos* they gradually taper from the middle to the apex; the veining of the wings being also different; the palpi less conspicuous in the former; and the thorax considerably more gibbous, as well as wider and shorter in proportion.

It may furthermore not be unworthy of notice, that among the hitherto described species of *Xenos*, a portion (including the type of the genus) being parasitic upon the social *Vespidæ*, whose larvæ subsist on disgorged juices, chiefly of vegetable extraction, administered to them from mouth to mouth in open cells,—whereas another portion, being derived from the solitary and exclusively carnivorous *Sphegidæ* &c., reared in closed cells, wherein the young hexapod must therefore be incarcerated at a time when, as in the solitary *Mellifera*, the ovum and store only are to be met with,—it seems reasonable to infer that, inasmuch as all remarkable variations of structure afford presumptive evidence of corresponding modifications of economy, so, vice versâ, habits thus widely differing will also be typified in the minutiae of some peculiar character, whereby we may be enabled to discriminate the respective groups, and associate the species justly appertaining to each.

With reference to an opinion which has long prevailed, that the larvæ of the *Hylæi* are parasitical feeders on the stores of other *Mellifera*,—founded upon apparent structural incapacity in the perfect insect for the task of collecting and conveying nutriment for its progeny, this inference does not appear to be borne out in those which I have reared; for, having obtained a considerable number of specimens from cells adapted to the size of the larvæ, and constructed in appropriate channels through the pith, forming sometimes a double or triple series of parallel galleries, occasionally crossing each other (as in the accompanying briar marked *A.*), the peculiar transparent iridescent tapestry of the *Hylæi* being continued throughout each series of cells in uninterrupted succession, I cannot but infer that these are no casual intruders or predatory usurpers, but, on the contrary, rightful heirs of the original constructors and purveyors.

Similar parasitical habits have also been ascribed to other Hymenopterous insects, upon *primâ facie* evidence of structural organization,—such as the absence of pollen-plates and pollen-brushes in the pollinivorous, or the non-existence of spinal armature of the tibiæ, considered essential to the Zoophagous for the transport of their prey,—which inferences, however, more careful

observation has in several instances served to disprove. Thus, in an interesting notice which appeared some time since in the *Annales* of the French Entomological Society, (tome 9, premier trimestre, 1840,) “sur les Insectes Hyménoptères qui nichent dans l’Intérieur des Tiges sèches de la Ronce” (p. 35), the writers (MM. Léon Dufour and Edouard Perris) have evinced a laudable desire to vindicate the reputation of some of their Hymenopterous protégés from the aspersions previously cast upon them in this respect,—as in the case of *Ceratina* (pp. 16—23) and *Trypoxylon* (pp. 28—33); while however they arrive at a different conclusion respecting a species of *Hylæus* they had in like manner reared from briars (the *Prosopis signata* or *annulata*), upon which head they remark as follows: “La *Prosopis* usurpe les nids de l’*Osmia parvula*, et ses larves réduisent celles de cette *Apiaire* à mourir de faim, en dévorant les provisions recueillies par cette dernière.”—p. 35.

I have myself, on more than one occasion, reared specimens of *Hylæus* from briars wherein a species of *Osmia* was also met with,—such being however unusual and exceptional cases, when the cells of the one appeared perfectly independent of those of the other; the *Hylæus* having, as I conceive, simply availed itself of the unoccupied portion of an excavated briar, after the *Osmia* had completed her labours; the cells constructed by the latter, and the pupa-cases of her young, forming an uninterrupted series lower down,—the limits of the slender tapestry of the *Hylæi* above being readily distinguishable, and on one occasion a deposit of liquid acidulous honey being found intermediate between the two (as in the accompanying briar marked *B*).

Whence could this honey have proceeded, and for what purpose could it have been collected and deposited? Can this be the nature of the food upon which the *Hylæus* larvæ subsist, and could it have found its way hither by exuding from the cells of the *Hylæi*, or have been so placed to prevent the egress of the *Osmia*? This is a problem difficult to explain; the solution of which, as defining the habits and economy of the *Hylæi*, offers an interesting subject of inquiry.

The allied genus *Colletes* (long known as a constructor,* and furnished with polliniferous organs) has been observed by Mr. Smith filling her cells with a “liquid mixture of pollen and honey;”† and may not the *Hylæi* also—the peculiar conformation of whose oral organs, as well as those of *Colletes*, approximates to that of the social *Vespidæ*—supply their larvæ with some viscous

* Reaumur, Mem. 5, tom. vi.

† Zoologist, 1846, p. 1275.

saccharine essences, possibly in a less condensed form? At all events I feel assured, from the circumstances under which I have usually found them, as already narrated, that their alleged parasitical habits will ere long be disproved, as in the case of *Ceratina*.

It should also be remarked, that it is not an uncommon occurrence for briars previously occupied by the progeny of one insect, to be again made available by a different insect after the original tenants have quitted their abode; and that on one occasion I found some pupæ of *Hylæus* ensconced in a mud-cased briar containing the deserted cells of an *Odynerus*; the *Hylæi* in this instance being arranged obliquely, on account of the large diameter of the excavated channel (as in the briar marked *C.*, to which is appended a specimen of the *Hylæus* reared therefrom, and some of the pupæ in spirits). It will however scarcely be contended that the *Hylæi* in this instance were parasitical feeders upon the store laid up for the Zoophagous *Odynerus* larvæ, nor is there any trace of subsequent occupation by an *Osmia*.

The same remarks equally apply to another briar (now exhibited and marked *D*), the lower end of which I found to be tenanted by three larvæ of *Cemonus*, with several others of *Hylæus* above, the tapestry of the latter serving to determine the limits of each: but, having carefully reunited the split portions of the briar for the purpose of ascertaining the result of this joint occupancy, the time for the appearance of the perfect *Cemoni* being prior to that of the *Hylæi*, the former alone were produced, having annihilated the latter while effecting their exit towards the middle of May; and it would seem not improbable that a similar result should ensue in the briars occupied by *Osmia* and *Hylæus* as aforesaid, unless the progeny of the original constructor be altogether precluded from issuing, there being no other opening for the purpose, nor do the *Osmiæ* ever perforate the side of the briar; and the lodgment of the *Hylæus* being subsequently effected, the former must have belonged to a species which attains maturity before the latter,—like the *Osmia ruborum* of the French writers already referred to, produced early in May.

The *Trypoxylon* also is not averse to profit by such opportunities of economizing labour; which the same writers characterize as “une sorte d'intelligence industrielle,” surpassing the ordinary inspirations of instinct, although not unattended with risk. This insect however usually prepares for its larvæ a gallery, with cells proportioned to their size, excavated amid the main body of pith. The distinction which the same writers have pointed out, between such casual appropriations of a deserted tenement, from which the

entire pith has been removed by some former constructor, and the ordinary proceedings of the *Trypoxylon* as aforesaid, equally applies to the *Hylæi*, whose diminutive tunnels, perforating and often winding through the pith, essentially differ from any made by an *Osmia* or an *Odynerus*.

In concluding these observations upon the *Strepsiptera*, and the insects on which they parasitically subsist,—a subject wherewith the name of our honorary President is indissolubly associated,—I cannot better dispose of the specimens illustrative of this communication than by consigning them to the Museum of this Society.

DIAGNOSIS OF THE SPECIMENS.

1. *Hylecthrus Rubi*, ♂. (Pl. VIII. fig. 1), with its foster-parent *Hylæus versicolor* ♀.
2. Bred-specimens of the *Hylecthrus Rubi* ♀. (Pl. VIII. fig. 2a—2d), with *Hylæus rubicola*, ♂ and ♀.
3. Cephalo-thorax of hexapod-bearing female (Pl. VIII. fig. 2e), with some of her progeny.
4. Corneous operculum of pupa-case of the male (Pl. VIII. fig. 1h).
5. *Hylecthrus Quercûs* ♂.
6. *Hylæus gibbus* ♀, with exuviae of the preceding.

BRIARS.

- A. Briar exhibiting the normal construction of the cells of *Hylæus versicolor* and *rubicola*, in galleries perforating the pith,—often in a double or triple parallel series, as in this instance.
- B. Briar-snap excavated by an *Osmia*, whose pupa-cases remain below; the upper portion being occupied by *Hylæi*, and the intervening space having contained some liquid acidulous honey.
 - B. 1. Specimen of the *Osmia*.
 - B. 2. Pupa of the same in spirits.
- C. Briar containing the mud-constructed cells of a large *Odynerus*, with others of *Hylæus* superposed, and arranged obliquely.
 - C. 1. *Hylæus* reared from this briar.
 - C. 2. Nymph of the same in spirits.
- D. Briar occupied in part by *Cemonus unicolor*, with the tapestried cells of *Hylæus* above; the occupants of the latter having been destroyed when the *Cemoni* effected their exit.

Order STREPSIPTERA, Kirby.

Genus HYLECTHURUS.* (Pl. VIII.)

Caput magnum, transversum. *Oculi* ingentes. *Antennæ* 5-articulatæ; articulo basali brevi; secundo parvo, truncato; tertio longissimo, spatulato, totâ ferè latitudine subæquali, quartumque basin versùs latere externo ferenti; hoc parvo, annuloso; extimo (5to) tertio simillimo, et in illum recumbenti. *Palpi* parvi, articulo basali crassiori, apice obliquo; apicali graciliori, setoso. *Thorax* anticè constrictus, disco gibbosus; capiti latitudine subæquali; scutello maximo; elongato-triangulari, margine antico sinuato, lateribus rectis, angulo postico subacuto porrecto. *Pseudelytra* parva, apice valdè dilatato, crassiori, subconcano. *Alæ*, costæ dimidio basali inspissato, seu potiùs venâ subcostali abbreviatâ cum costâ quasi conjunctâ; primâ discoidali, prope basin furcatâ, ramo antico ejus cum costâ parallelo, ultra medium alæ evanescenti, ramo postico ejusdem longitudinis, recto, deflexo: prope apicem alæ incrassatio exstat, cujus basis, venaque duplex tenuissima de margine externo sinuatè producta, intra furcam retrò extendunt: venis reliquis rectis, deflexis; quarum una gracilis, margini externo attingens; duæ subapproximatæ, margini interno propiores, basi robustiores; altera (?) analis ferè oblitterata. *Abdomen* valdè constrictum. *Pedes* longitudine mediocres, posteriorum tibiis dilatatis, compressis, genibus constrictis; tarsorum articulis quatuor, apicali integro. Mas.

Femina (cui, modo congenerarum, alæ, pedes, antennæ, necnon oculi, desunt), vermiformis; cephalothoracem complanatum, suprâ subconvexum, infrâ subconcavum, e dorso apic educantis tantum modò protrudens; vaginæ aditû, olim clauso, post coitum sat amplè patentî.

Sp. 1. *Hylecthrus Rubi*. (Pl. VIII. figs. 1, 2, 3, and details.)

Niger, gibbosus; pedibus luteis; alis lacteis, venis saturatè piceis. Mas.

Long. corp. $\frac{1}{2}$ — $\frac{5}{8}$ lin. Expans. alar. ferè $1\frac{1}{2}$ lin.

Femina, nuper declarata, cephalothorace pallido, lineolâ marginali tenuissimâ nigricanti; vittâ utrinque, maculis binis

* From Hylæus, and ἐχθρὸς, hostis.

parvis transversis prope basin, angulisque posticis, brunneis : parturientes autem disco convexiori, ferè omninò flavescenti, vittâ mediâ longitudinali dilutiori.

Habitat in Epiro, intra corpus *Hylæi versicoloris* parasiticus.

Fig. 1, male ; fig. 2, details of female ; fig. 3, young larvæ.

Sp. 2. *Hylecthrus Quercûs*.

Differt magnitudine duplò majori, alis parùm obscurioribus, venisque magis nigricantibus. Mas.

Long. corp. $\frac{2}{3}$ —1 lin. Expans. alar. ferè $1\frac{3}{4}$ lin.

Individua mutilata tantum vidi.

Habitat in Epiro, *Hylæi gibbi* parasitus.

Order HYMENOPTERA.

Section MELLIFERA, Latr.

Family ANDRENIDÆ, Latr.

Genus HYLÆUS, Latr. (PROSOPIS, Jurine.)

Sp. 1. *Hylæus rubicola*.

Niger ; genis, clypeique puncto, luteis, vel albicantibus, vel denique omninò nigris ; antennis subtùs ferrugineis ; prothoracis lineolâ sæpè interruptâ, humeris, squamâque alarum, flavescentibus ; tibiis tarsisque plus minusve ferrugineis vel pallidis ; abdominis segmento primo omninò, secundo nonnunquam ad basin, rufo-fulvis, reliquis nigro-piceis, marginibus posticis pallidioribus ; alis subhyalinis, venis piceis. Femina.

Long. corp. $\frac{5}{4}$ unc. Exp. alar. $\frac{7}{4}$ unc.

Mas differt, genis clypeoque albidis ; thorace, abdomine, squamâque alarum, nigris.

Habitat in Epiro, circum Ambracicum Sinum, in rubos exsiccatos fodiens.

Sp. 2. *Hylæus versicolor*. (Pl. VIII. fig. 4.)

Niger ; genis, clypei lineâ, prothoracis lineâ interruptâ, humeris, squamâque alarum, flavescentibus ; antennis subtùs ferrugineis ; tibiis tarsisque anterioribus ferè omninò, intermediis posterioribusque basin versus, pallidioribus ; abdomine vel toto vel parte majori pallidè flavo ; alis subhyalinis, venis piceis. Femina.

Long. corp. $\frac{5}{24}$ unc. Exp. alar. $\frac{7}{24}$ unc.

Variat genis luteis, clypei puncto concolori, vel disco omninò nigro.

Habitat in Epiro, in rubis exsiccatis. (An species distincta?)

The dissimilarity in appearance between this and the preceding species is very striking, but although I am inclined to consider the difference as resulting from parasitical attack, it would perhaps be hazardous to assert this without further proof. It is, however, remarkable that all the male parasites which I have obtained were derived from these pale-coloured specimens, whereas the apterous females were restricted to the former,—a circumstance not unworthy of attention, as connected with the physiology of sexual development.

Sp. 3. *Hylæus gibbus*.

Niger, gibbosus; genis tibiisque anterioribus anticè, luteis; posterioribus ad basin, intermediis vix, tarsorumque quatuor posteriorum articulo primo, albicantibus; antennis subtùs ferrugineis; prothoracis lineolâ interruptâ tenui, humeris, alarumque squamâ, flavescentibus; abdomine nigro; alis fuscescentibus, venis piceis. Femina.

Long. corp. 3 lin. Expans. alar. $4\frac{1}{2}$ lin.

Habitat in Epiro, prope Sinum Ambracicum, in gallis querceis.

The *Hylethrus Quercús* was obtained from this species, the abdomen exhibiting irregular rufous patches in some specimens parasitically affected.
